Gempa Bumi


1985 Mexico City Earthquake

Apa Gempa Bumi?

- Energi dalam bentuk getaran yang dihasilkan oleh bumi
- Energi ini memancar ke segala arah dari pusat gempa
- Tempat yang rawan gempa akan menyimpan alat pengukur gempa

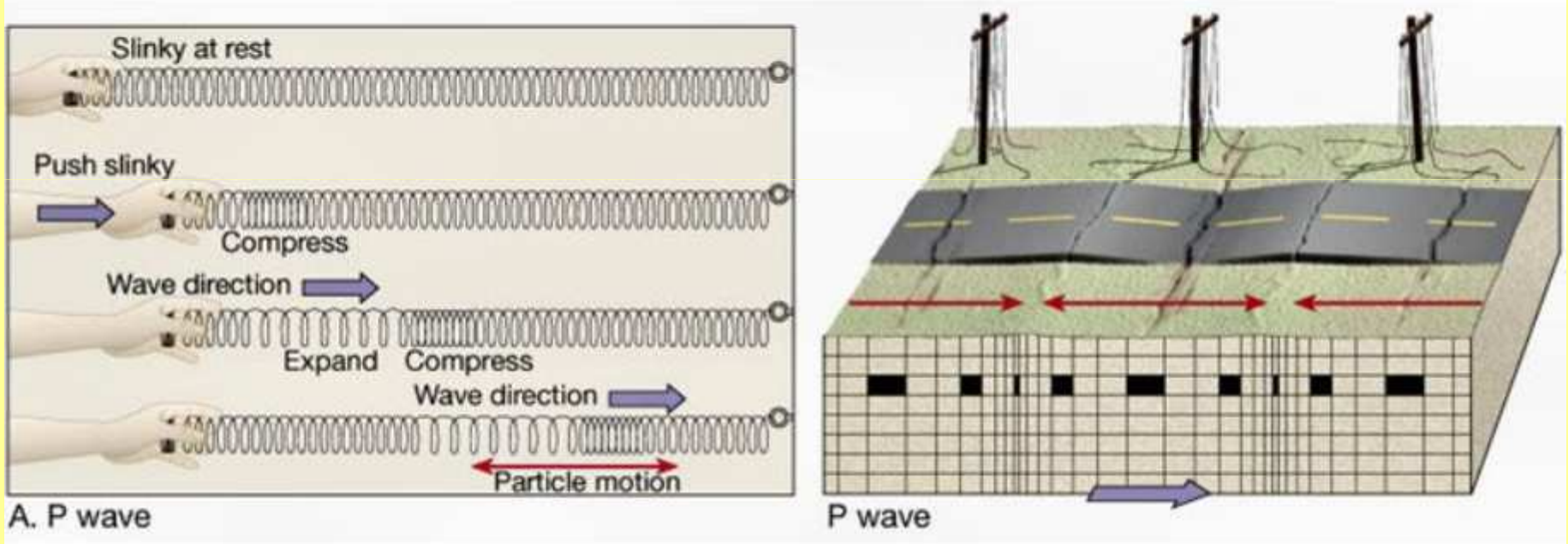
Klasifikasi gempa

- Penyebab
  - Vulkanik
  - tektonik
- Letak Pusat Gempa
  - Dangkal, 0-60 km
  - Menengah, 60-300 km
  - Dalam,>300 km

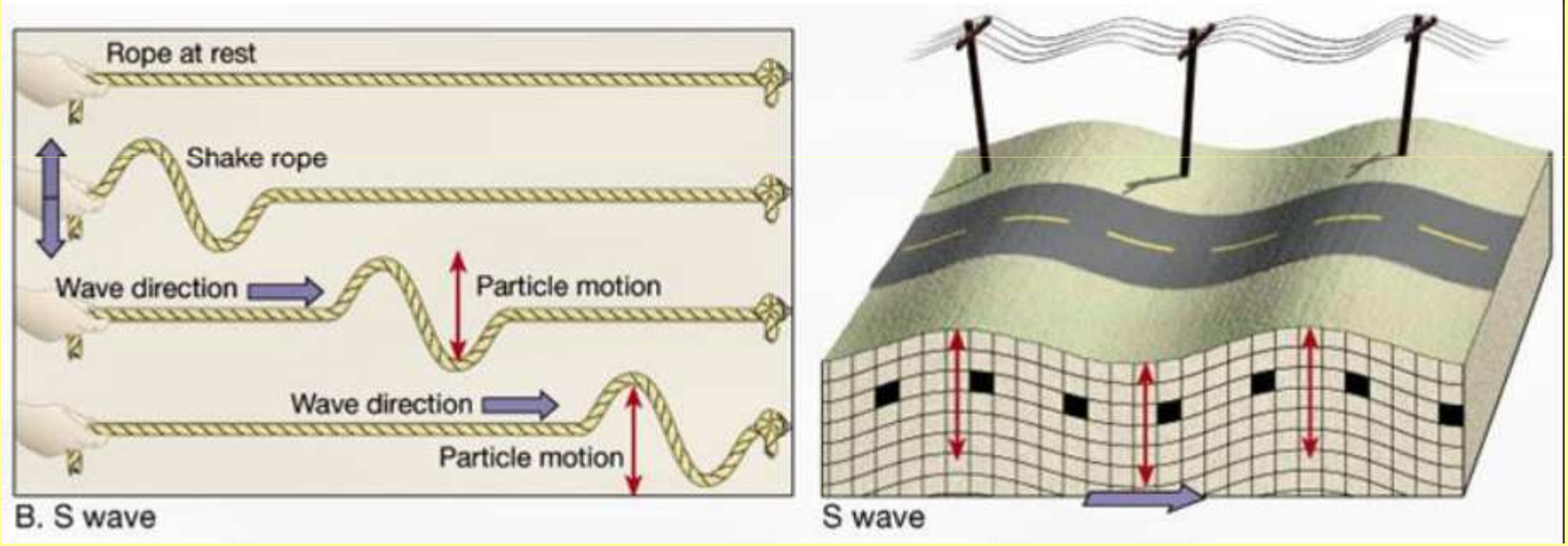
Gelombang Gempa Bumi

- Body Waves
  - Bergerak dari dalam struktur bumi (Focus)
  - Terdiri dari gelombang P dan gelombang S
- Surface Waves
  - Penjalarannya lebih lambat dibanding body waves
  - Bergerak di permukaan bumi (Episentrum)
  - Gelombang Rayleigh, bergerak seperti gelombang laut

Primary (P) waves



Secondary (S) waves



Gelombang Rayleigh

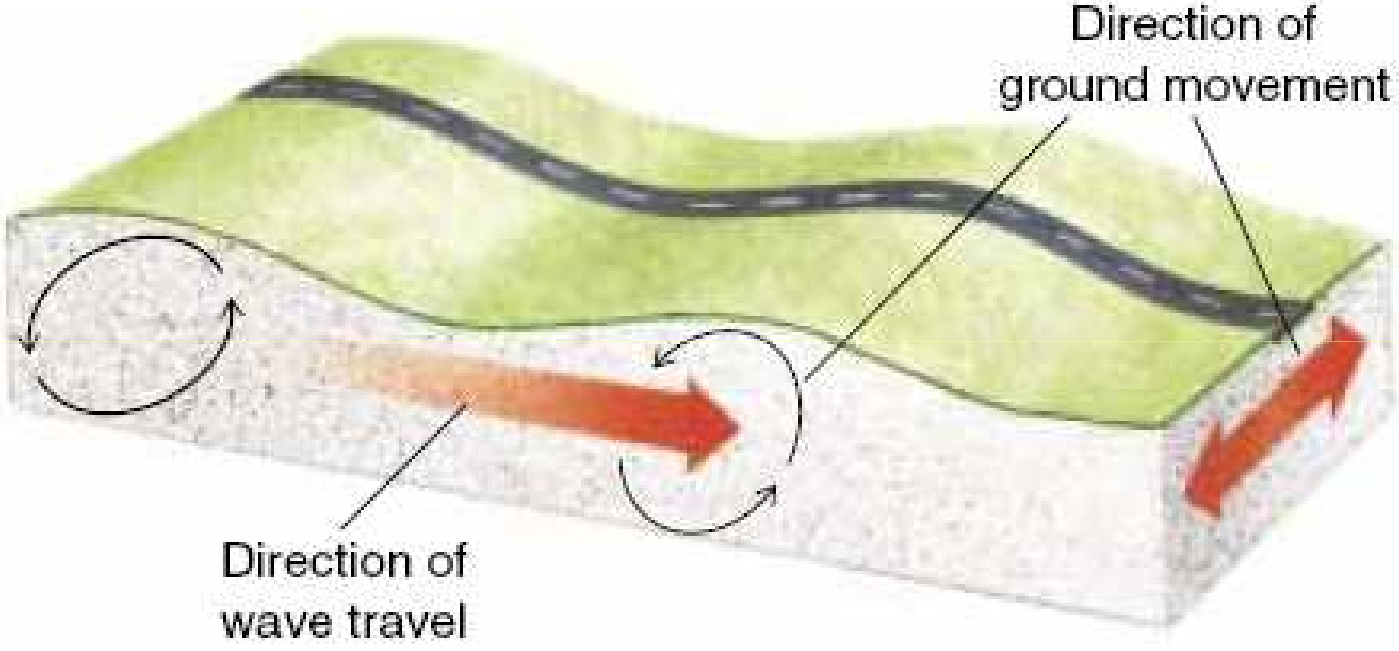


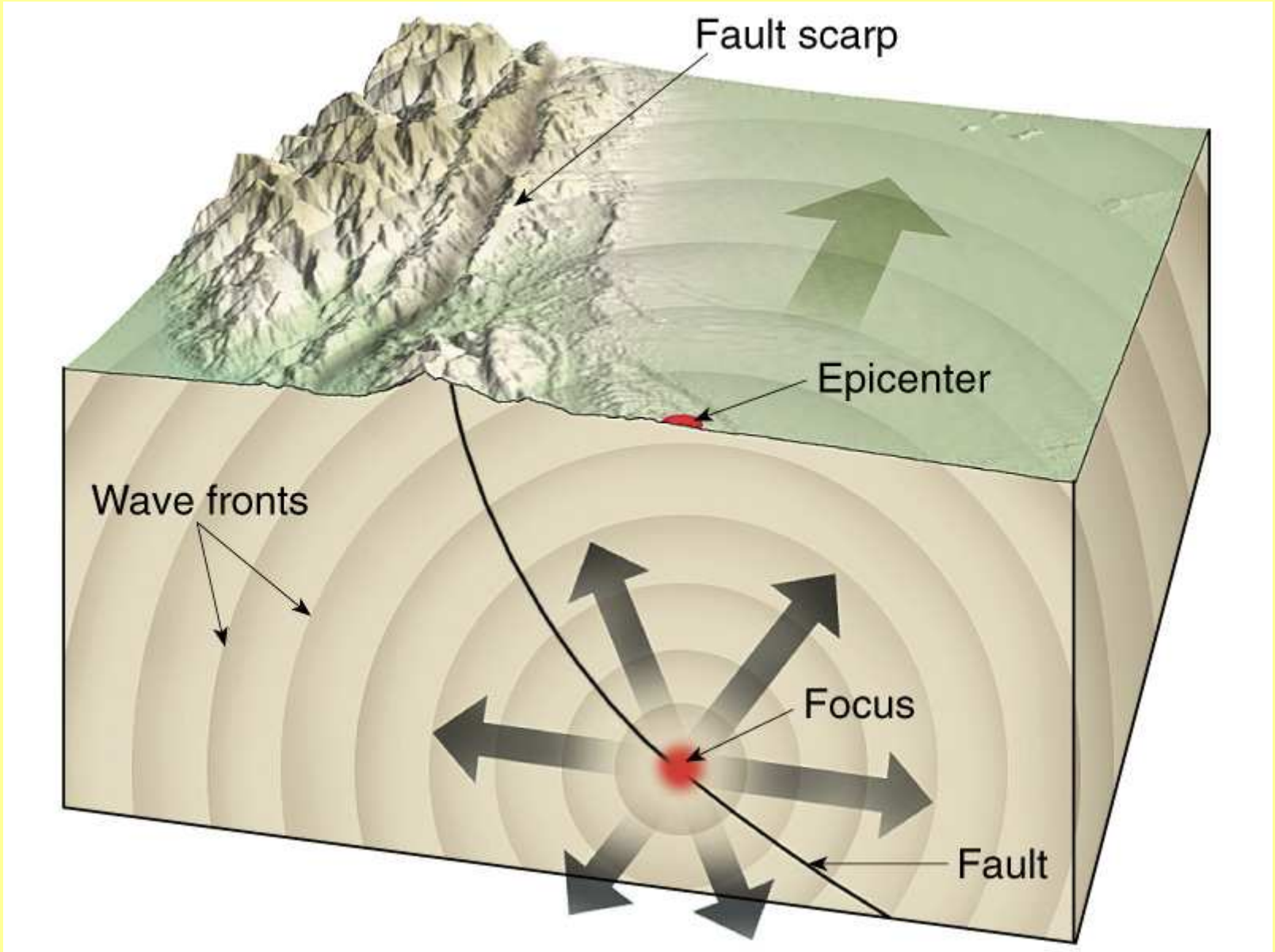
Figure 10–8 Surface waves. Surface motion includes up-and-down movement like that of an ocean wave and also a side-to-side sway.

Gelombang Gempa

- Gelombang Longitudinal, P (Primer) : bergerak dari Hiposentrum dengan kecepatan 4–7 km/s
- Gelombang Transversal, S (Sekunder) : Bergerak dari Hiposentrum dengan kecepatan 2 – 5 km/s
- Gelombang Permukaan : Bergerak dari Episentrum dengan kecepatan 3 – 4 km/s

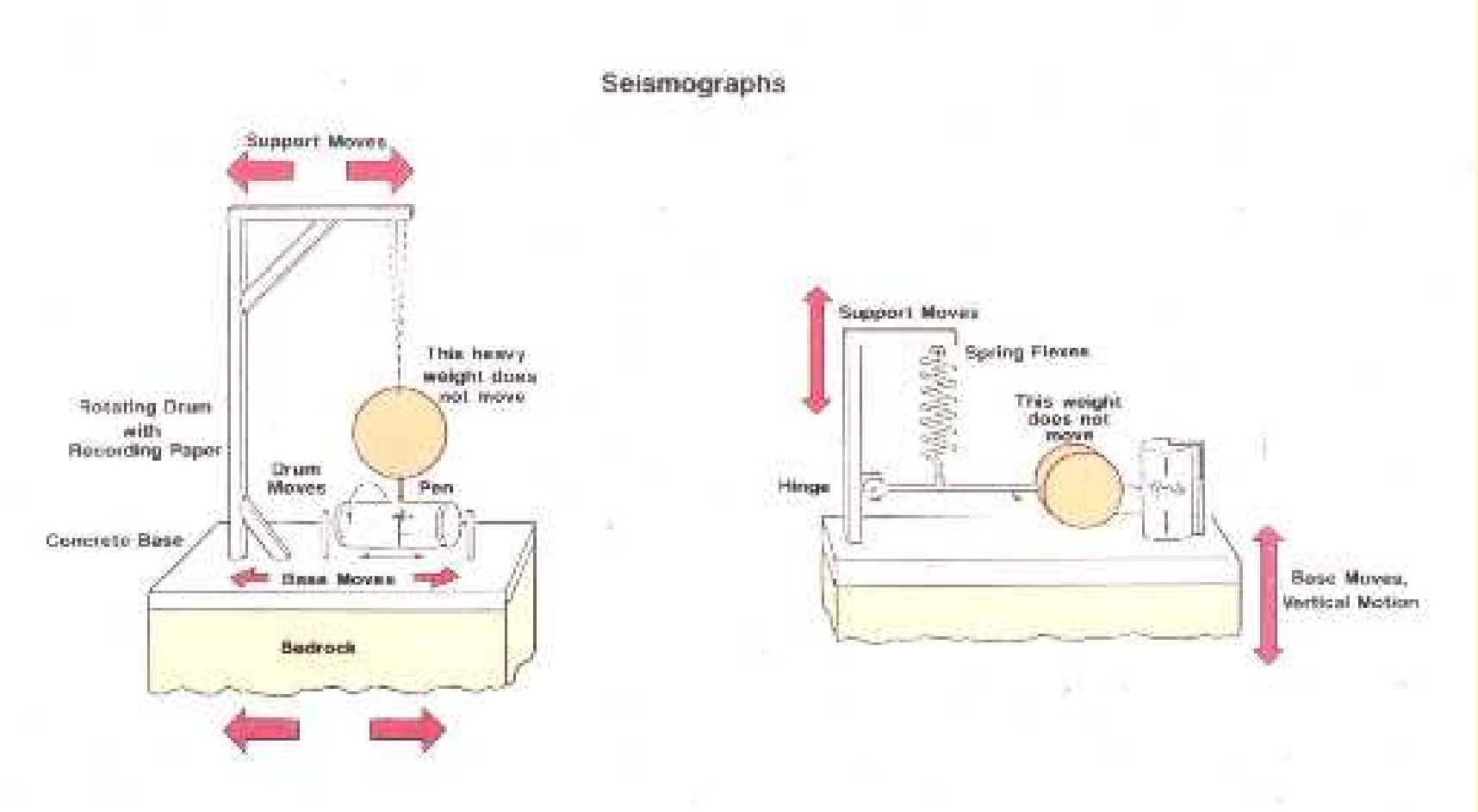
Lokasi Gempa Bumi

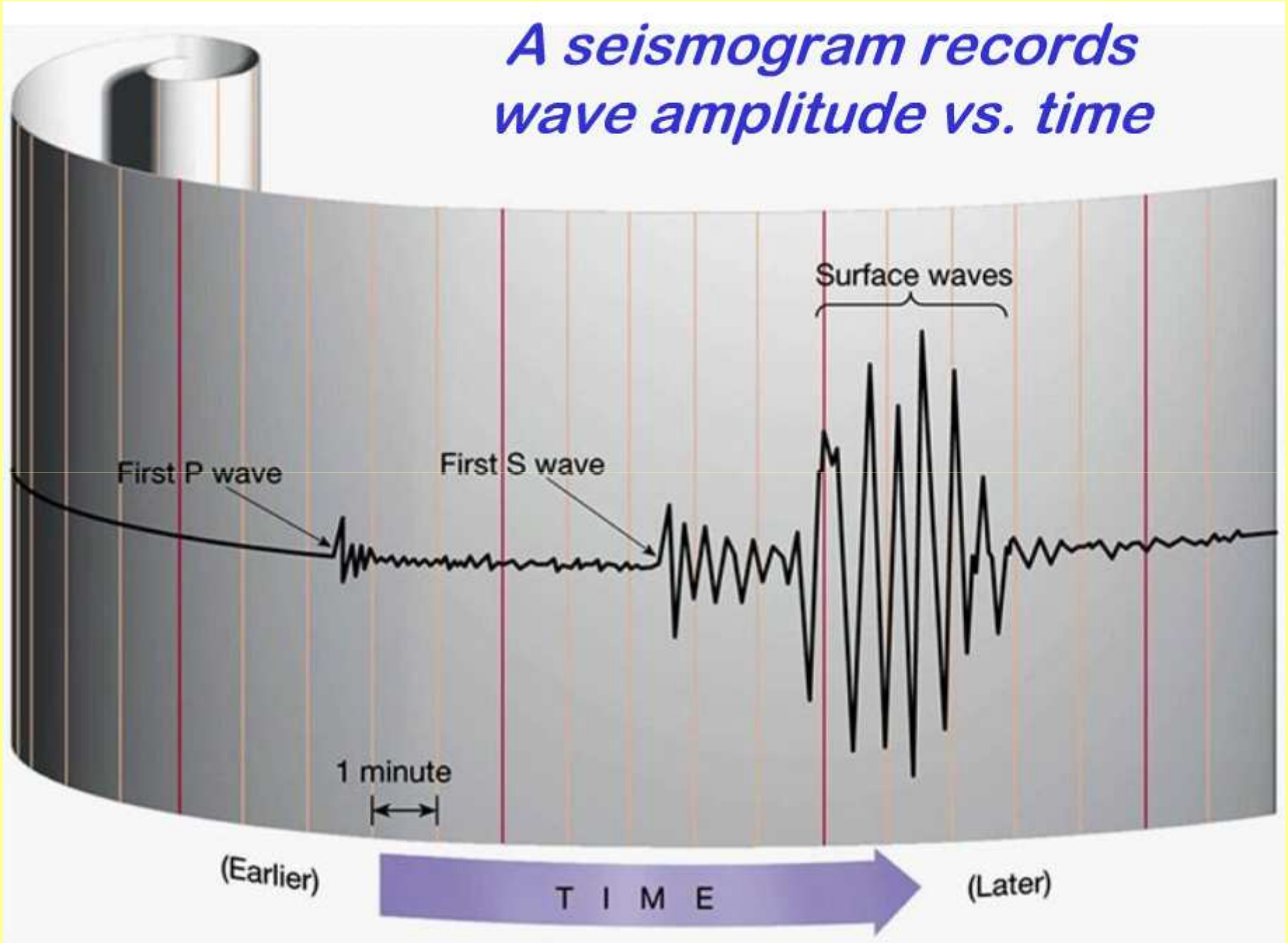
- Ada beberapa istilah
  - Episentrum
  - Hiposentrum atau Focus
  - Foreshocks
  - Aftershocks
- Perbedaan kecepatan gelombang P dan gelombang S dapat menentukan episentrum gempa


Fault scarp
Epicenter
Wave fronts
Focus
Fault

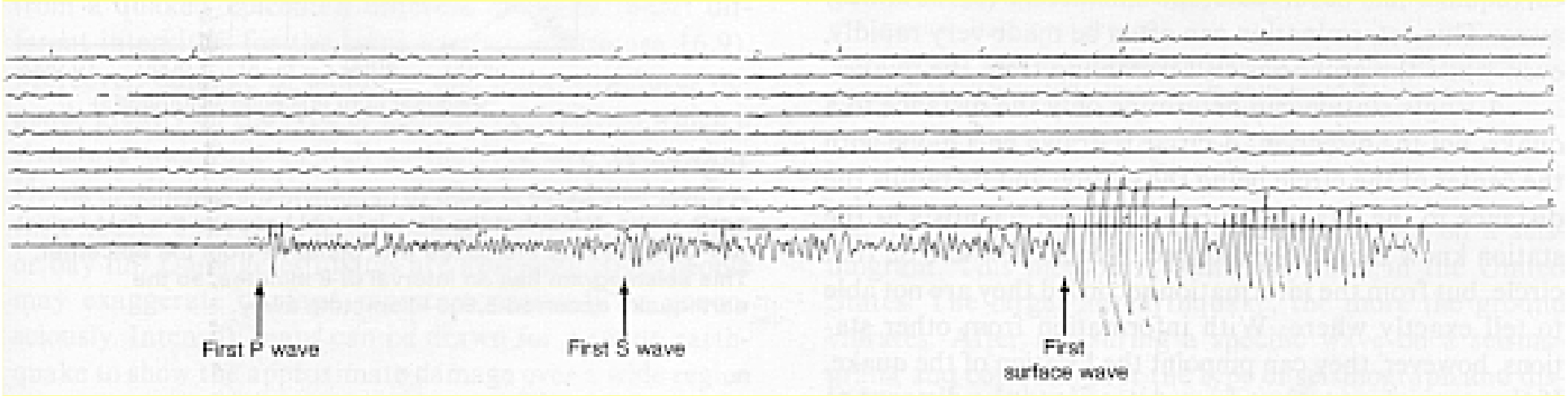
Model Seismogram

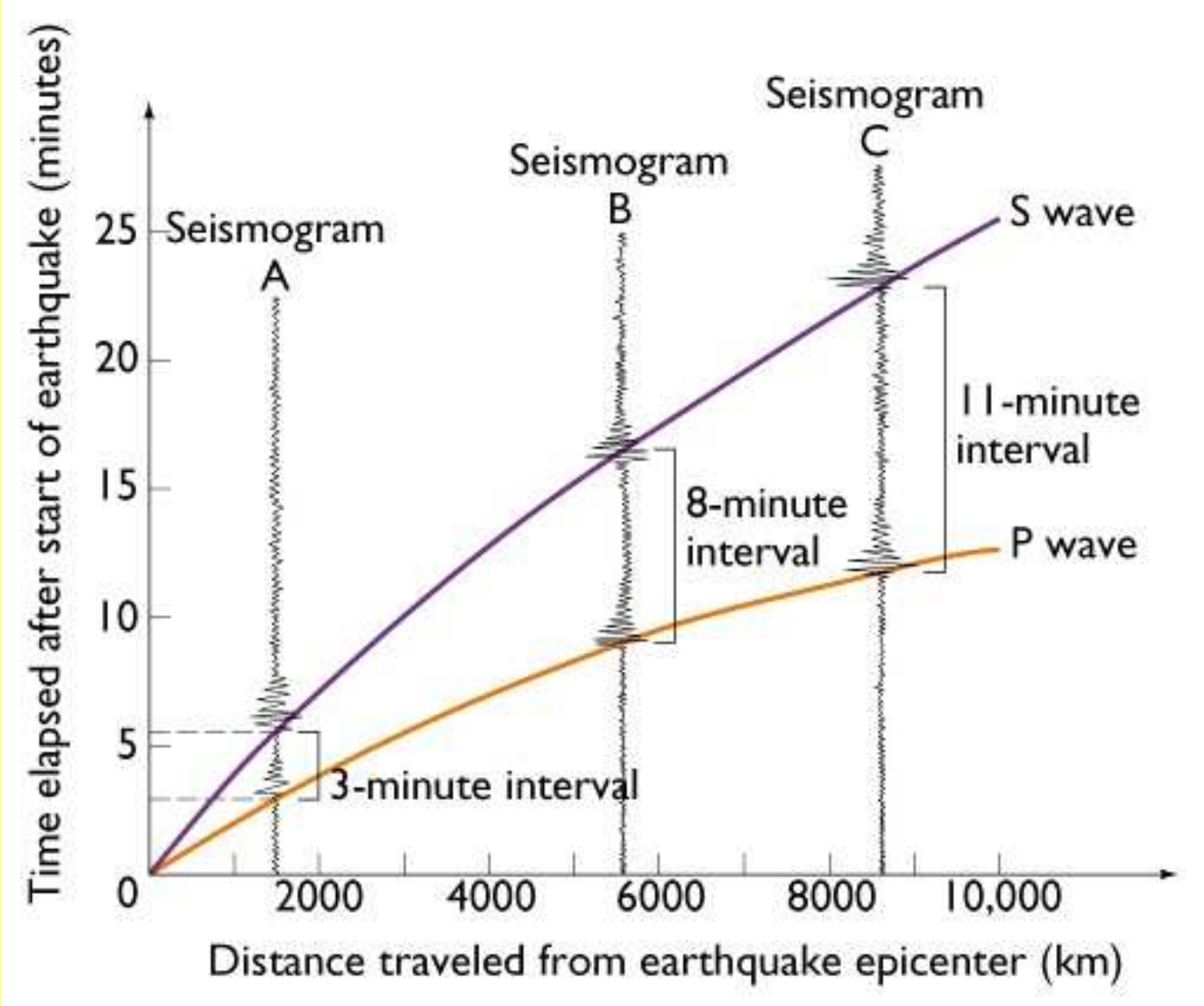
Pendulum Seismometers

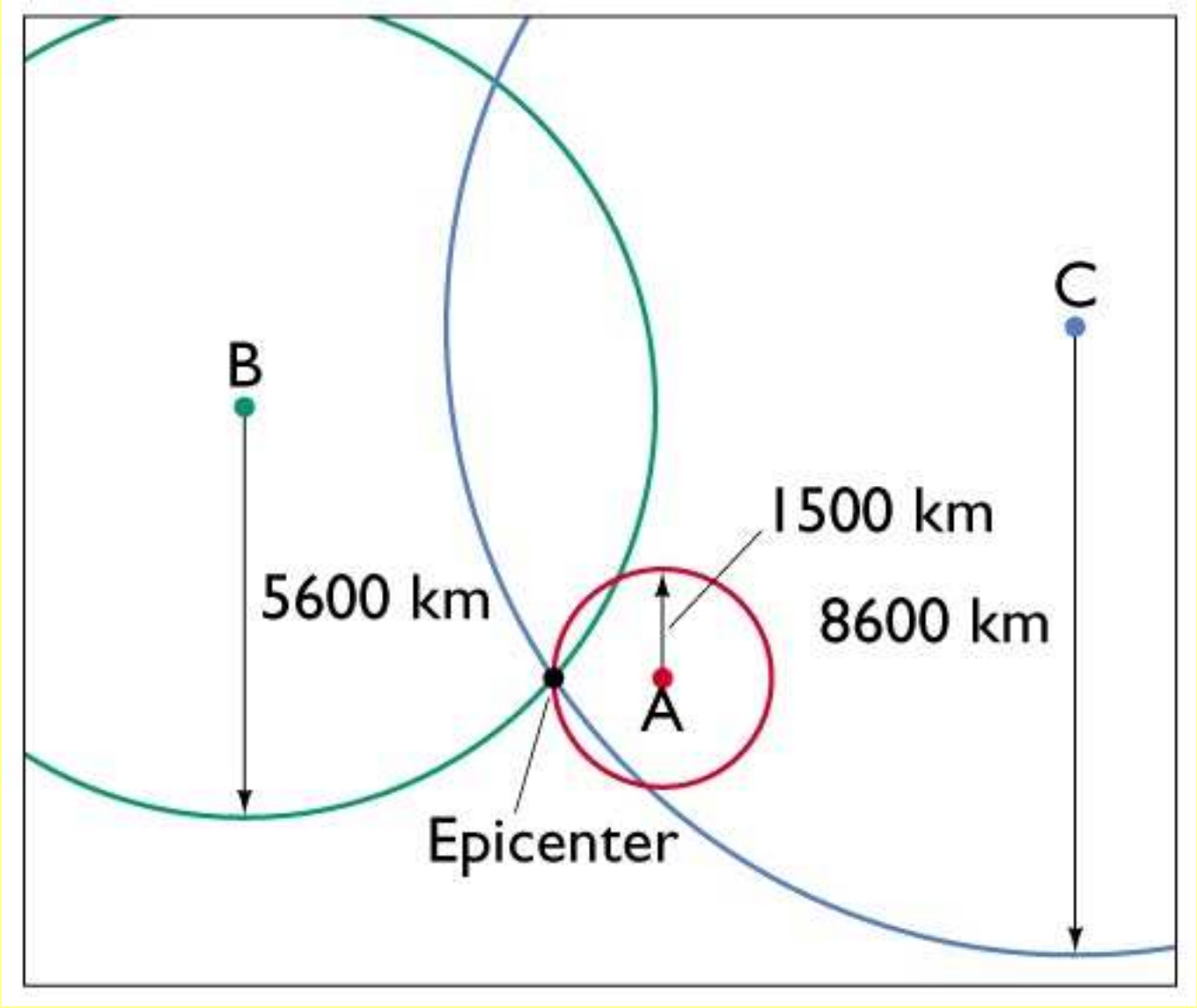



A seismogram records wave amplitude vs. time
Surface waves
First P wave
First S wave
1 minute
(Earlier)
T I M E
(Later)

Sinyal Seismogram

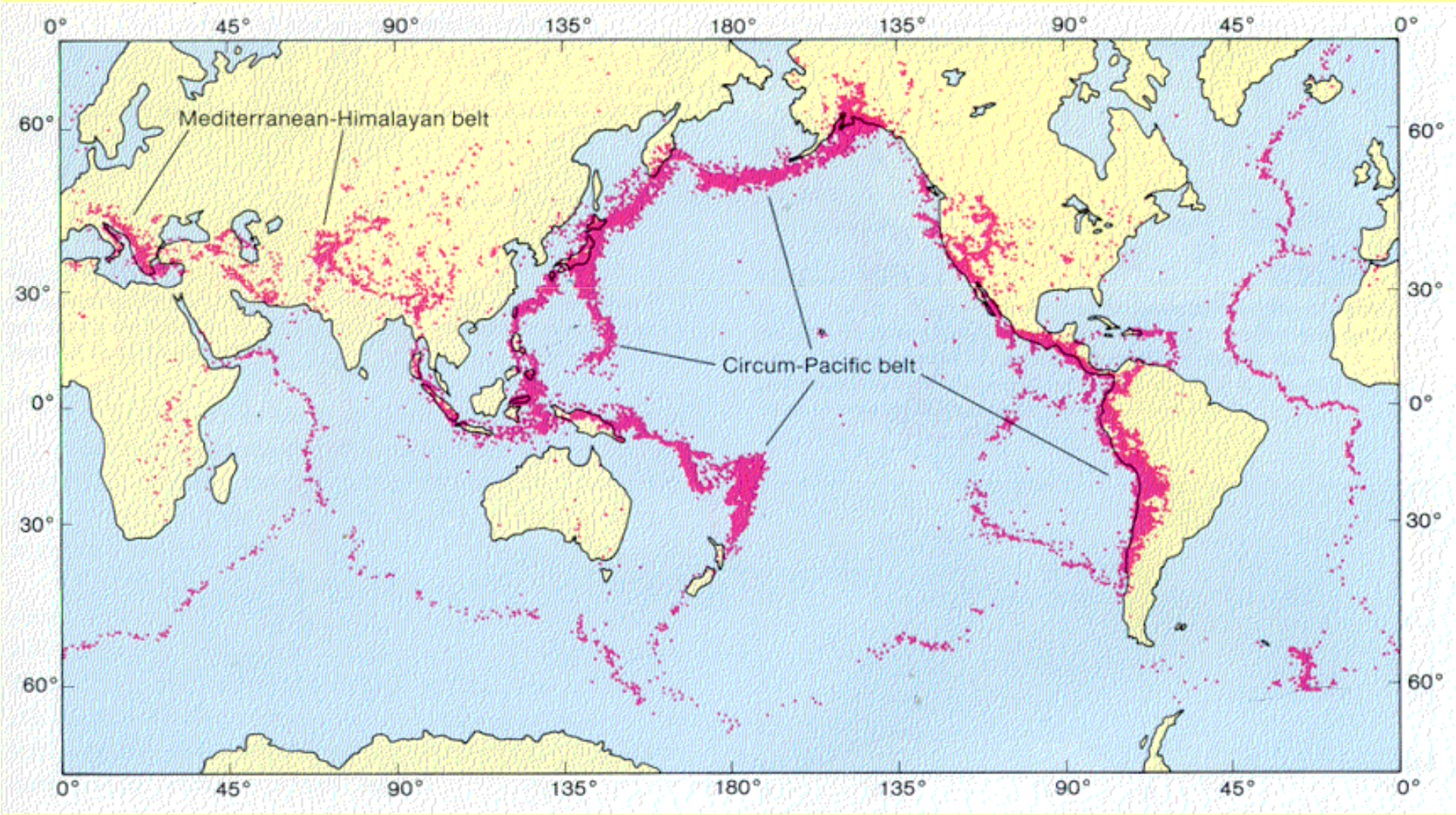



Seismogram A
Seismogram B
Seismogram C
S wave
P wave
3-minute interval
8-minute interval
11-minute interval
Time elapsed after start of earthquake (minutes)
0
5
10
15
20
25
2000
4000
6000
8000
10,000
Distance traveled from earthquake epicenter (km)


B
C
5600 km
1500 km
8600 km
A
Epicenter

Epicenter is located using three or more seismographs

Distribusi gempa



Gempa bumi dapat diukur dengan 2 bentuk ukuran:

1. **Intensity**
2. **Magnitude**

Skala Intensitas, yaitu skala Mercalli

Rata-rata I (tidak terasa) sampai XII (rusak total)

Skala Magnitude,yaitu skala Richter

Yang tidak terasa mulai dari >3.4 sampai yang rusak total >8

Mercalli vs. Richter

Modified Mercalli Scale		Magnitude Scale
I	Detected only by sensitive instruments	1.5
II	Felt by few persons at rest, especially on upper floors; delicately suspended objects may swing	2
III	Felt noticeably indoors, but not always recognized as earthquake; standing autos rock slightly, vibrations like passing truck	2.5
IV	Felt indoors by many, outdoors by few, at night some awaken; dishes, windows, doors disturbed; standing autos rock noticeably	3
V	Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects	3.5 4
VI	Felt by all, many frightened and run outdoors; falling plaster and chimneys, damage small	4.5
VII	Everybody runs outdoors; damage to buildings varies depending on quality of construction; noticed by drivers of autos	5
VIII	Panel walls thrown out of frames; walls, monuments, chimneys fall; sand and mud ejected; drivers of autos disturbed	5.5 6
IX	Buildings shifted off foundations, cracked, thrown out of plumb; ground cracked; underground pipes broken	6.5
X	Most masonry and frame structures destroyed; ground cracked, rails bent, landslides	7
XI	Few structures remain standing; bridges destroyed, fissures in ground, pipes broken, landslides, rails bent	7.5
XII	Damage total; waves seen on ground surface, lines of sight and level distorted, objects thrown up into air	8

Bencana Gempa

Tanah longsor

Bencana Gempa

Marina District, San Fransisco, 1989

Bencana Gempa

Pergeseran tanah

Bencana Gempa